DOCUMENT RESUME

ED 090 283 TM 003 562

AUTHOR	Tuckman, Howard P.
TITLE	Teacher Effectiveness and Student Performance.
INSTITUTION	Florida State Univ., Tallahassee. Inst. for Social Research.
SPONS AGENCY	Joint Council on Economic Education, New York, N.Y.
PUB DATE	[Apr 74]
NOTE	20p.; Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, Illinois, April 1974)
EDRS PRICE	MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS	*Academic Achievement; *Academic Performance; *Course Evaluation; Economics; *Effective Teaching; Graduate Professors; Graduate Students; Teachers; *Teaching Experience
IDENTIFIERS	Test of Understanding in College Economics; TUCE

ABSTRACT

During the last few years, a number of economists have studied the effects of employing different teaching resources on the performance of economics students. Despite widespread interest in the impact of various inputs on the amount learned by students, little attention has been devoted to the choice of output measure. This paper argues in favor of the use of a variety of measures in analyzing resource effectiveness. To illustrate the importance of this position, several resource allocation questions are considered: (1) Do experienced teachers do a better job of teaching economics than less experienced ones? (2) Are graduate students as effective at teaching economics as members of the faculty? (3) Does the hour at which an economics course is taught have any effect on student performance? The data to answer these questions were obtained from pre and post questionnaires administered to successive macroeconomic principles classes at Florida State University. A total of 301 students were included in the sample. (Author)

Session 5:05.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

5.05

ED 090283

ED 003 562

TEACHER EFFECTIVENESS AND STUDENT PERFORMANCE

Howard P. Tuckman

In this paper we evaluate the effects of using experienced teachers as compared to graduate instructors in the macroeconomic principles course at Florida State University. As contrasted to earlier studies these questions are explored using five different measures of classroom "output."(1)(9)(10)(13)(19). Our results suggest that graduate students do as well as the overall faculty on each of the output measures, although experienced teachers raise student learning scores over the sample average.

Determining Acceptable Measures of Student Performance

An acceptable measure of student performance is a necessary prerequisite for any study of teacher effectiveness. The problem is that using a single measure may have the undesired effect of causing an increase in "measured" rather than "desired" output.(8) In reality several things are going on in the classroom and, ideally, we should like to capture the most important. For this reason, we have chosen to work with five different

---

Associate Professor of Economics and Research Associate, Institute for Social Research, Florida State University. Funds for the data collection were provided by the Joint Council on Economic Education. I would like to thank Yadollah Khosravi and William James for their research assistance and Al Bayer, E. Ray Canterbery, Irvin Sobel, and Phillip Sorensen for their comments.

measures. The first is the Test of Understanding in College Economics (TUCE) which is a nationally normed and widely accepted test of learning. Participation by economists in question selection, weighting of subject matter, and testing for validity and reliability gives the exam a high degree of respectability. Several studies confirm its ability to discriminate between "good" and "poor" students (14) as well as its freedom from political bias and capacity to capture critical thinking.(14)(22) Because TUCE takes a full class period to administer, we found it necessary to select a limited number of questions from the exam. The evidence suggests that this did not substantially effect test reliability.[1]

A second measure of performance was obtained through the construction of a twenty question test of economic attitudes. Mann and Fusfeld (MF) define attitude sophistication (AS) in terms of a student's ability to take a position on an economic issue which accords with that of a majority of economists.(15) Measures of the MF type pose several problems since they are not free of value judgments (22) nor do they take account of existing theoretical divisions within the field. One might also question the ability of any exam to capture truth in one line. Nevertheless, it seems reasonable to assume that economic

---

1. Previous studies found that the TUCE questions have a high degree of internal reliability.(27) Using the Kuder-Richardson Formula 20, we obtained a test statistic of about 0.6 for the sample.

attitudes are changed by a principles course and that the change is likely to be in the direction suggested by both the textbook and the lecturer. The measure presented in this paper represents one way to capture attitude change. Obviously, others are also possible.[2]

Final grade of the student represents a third measure of performance. Because of the institutional arrangement at Florida State a common grading policy is not followed.[3] This raises several problems in interpreting the grade variable: (1) Instructors differ in what they think is important. Thus, the same student may get two different grades depending on which instructor's exam he takes. (2) Some instructors emphasize recapitulation of facts rather than applications. Thus, the final grade a student receives may reflect his ability to memorize without regard for his ability to work with new concepts. Nonetheless, a student's grade reflects the instructor's judgment of how well he performs. If some instructors are systematically biased in their judgments, this has a bearing on their

---

2. MF find that the AS measure tends to capture learning changes in subject-matter oriented students while grades are a better measure for success-oriented students. The teaching skills associated with each group tend to differ, suggesting that studies of teacher effectiveness should include both measures.(15)

3. This was not the case in the fall quarter where a common grading policy was followed to examine the possible bias introduced by using different grading scales. Our results (discussed below) suggest that graduate instructors were slightly less generous in the grades they gave students.

effectiveness and it is germane to our study.

The above measures of learning provide a valuable yardstick against which the effects of alternative approaches can be evaluated. Nonetheless, the principles class affects students in other ways worthy of further attention. If a high proportion of students plan to take additional courses in economics, for example, this may provide evidence of a successful presentation of the material. The same is true if student interest in economics increases.

In summary, the five performance measures are:

Q_1: Student score on a modified version of TUCE.

Q_2: Student score on a twenty question test of economic attitudes.

Q_3: Final grade for the quarter (A = 4, B = 3, C = 2, D or below = 1).

Q_4: End of the quarter interest in economics (5 = very high, 4 = high, 3 = average, 2 = low, 1 = very low).

Q_5: Willingness to take another course in economics. (1 = student intends to take another economics course which is non-required, 0 = otherwise).

Correlation Between Performance Measures

To illustrate more clearly the point that the various measures do not capture the same thing the zero order correlation coefficients for each measure are given in Table 1. Note that

the largest correlation (between AS and TUCE) is only 0.28. Moreover, a consistent pattern emerges; the correlations between the AS measure and other variables are generally higher than the correlations between TUCE and other measures and between final grade and the other measures. Moreover, all of the zero order correlations are fairly low.

TABLE 1

Zero Order Correlations Among the Dependent Variables

	TUCE	AS	Final Grade	Interest in Economics	Continuation
TUCE	-	0.28	-.07	-.12	.01
AS		-	.20	-.17	.07
Final Grade			-	.07	.04
Interest				-	.13
Continuation					-

Description of The Data

At the beginning of the 1972-73 Winter quarter and thereafter, successive macroeconomic principles classes at the Florida State University were asked to complete a detailed questionnaire. Information was obtained on student characteristics, grade point average, and attitudes on the pre-TUCE and pre-AS exams. A second questionnaire was administered at the end of the quarter. A total of 612 students completed the course and were tested.

Of these, 548 or 90 percent provided usable data.[4] In all, a total of 12 classes are included in the sample, taught by one Full Professor, two Associates, two Assistants, and three Graduate Instructors. The means and standard deviations for each of the independent variables appear in Appendix Table 1.

On the basis of prior studies of economic education the following variables were selected as the independent variables:

X_1 = Grade point average (5 = 3.5-4.0, 4 = 3.49-3.0,..., 1 = 1.99 or less)

X_2 = Score on TUCE pretest.

X_3 = Score on AS pretest.

X_4 = Sex dummy variable (1 = female, 0 = otherwise)

X_5 = Major dummy variable (1 = economics or natural science, 0 = otherwise)

X_6 = Interest in Economics (5 = very high, 4 = high,..., 1 = very low)

X_7 = Class of student (5 = graduate student, 4 = senior, ..., 1 = freshman)

---

4. Two factors account for the response rate. First, some students failed to enter a Social Security number on either the pre or post questionnaire. Statistical comparison of the unmatched data with the matched data revealed no significant bias from this source. Second, some students either entered the course late or failed to show up for the post-test. To partially minimize the latter problem, students were told that the post-test was a practice exam that would be helpful in preparing for the final. Since this practice was followed in the last two quarters it may have introduced a bias into the data. This was not evident in a visual check of the class means.

X_8 = Continuation dummy variable (1 = student plans to take another non-required economics course, 0 = otherwise).

Y_1 = Number of years since the instructor received his Ph.D. (A third year graduate student is two years away from receiving his Ph.D. and thus receives a -2 in the regression).

Y_2 = Number of hours taught by the instructor during the quarter.

Y_3 = Graduate Instructor dummy variable (1 = graduate instructor, 0 = otherwise).

Years of Teaching Experience and Student Performance

Several studies have shown that experienced teachers affect student performance. High school students taught by experienced teachers receive higher scores on national tests than those taught by less experienced teachers.(5)(12)(17) Likewise, experienced teachers produce fewer dropouts and more students who wish to pursue their education.(23) While the evidence on college students enrolled in economics courses is less extensive, it appears that experienced teachers improve student performance.

To explore this hypothesis further, regression analysis was utilized to determine the relationship between teacher experience and student performance after controlling for variables believed to be important. The least squares estimates obtained from OLS

estimation appear in Table 2. Each column of the table lists a different regression equation; each row gives the regression coefficients for one of the independent variables, along with its T-value (in parentheses). Only those coefficients with significant T-values are shown.

How does teacher experience affect student performance? The years beyond Ph.D. coefficient (Y_1) is statistically significant in both the TUCE and AS equations but not in the remaining ones. At the sample mean of 7.6 years of experience, for example, the average post-TUCE score is raised 0.3 points or 7 percent above the mean pre-TUCE score. A similar calculation for the post-AS score indicates that the post score rises by 0.65 points or 6 percent over the prescore mean. These are not large increases and they do not reflect well on our existing knowledge as to how to teach economic principles. In the post-TUCE equation, the effect of one year of additional teacher experience (0.039) is substantially less than that of increasing the average grade point of students by 0.1 points (0.054). What this seems to imply is that student rather than instructor quality may be the key to performance on economics exams. This would confirm the findings of other researchers regarding student performance in the absence of a faculty member.(20) It also provides some support of the Coleman Report conclusions at a college level.(23)

Could the findings reported here be due to problems with the Y_1 variable? Ideally, years of teaching experience rather

TABLE 2:

THE EFFECT OF TEACHER YEARS OF EXPERIENCE
AS INDICATED BY SEVERAL PERFORMANCE MEASURES

Independent variables	Post TUCE	Post AS	Final Grade	Interest in Economics	Continue on in Economics
Constant term	5.591 (16.5)	12.760 (18.4)	3.719 (14.5)	1.543 (8.9)	0.360 (6.0)
Grade Point(X_1)	0.542 (6.2)	0.631 (5.6)	0.376 (9.7)	-	-
Pre-TUCE(X_2)	0.219 (5.5)	-	-	-	-
Pre AS(X_3)	-	0.313 (9.5)	0.050 (4.3)	-	-
Sex(X_4)	-0.371 (2.1)	-	-	-0.306 (2.8)	-0.109 (3.1)
Major(X_5)	-	-	-	-	2/
Pre-Interest(X_6)	-	-	-	0.347 (5.7)	0.058 (2.9)
Class Standing(X_7)	-	-	-0.1190 (2.5)	-	-
Pre-Continue(X_8)	-	-	-	-	0.408 (8.5)
Years beyond Ph.D.(Y_1)	0.039 (4.0)	0.085 (3.7)	-	-	-
Number of Hours Taught(Y_2)	-	-0.462 (5.1)	1/	-	-
Adjusted R^2	0.18	0.25	0.22	0.08	0.21
F-Ratio	27.11	40.94	33.27	22.68	31.95
Adjusted standard error	1.87	2.44	0.84	1.17	0.38

Table Note: 1/ The coefficient on this variable was significant at the 10% level.

2/ Significant at 5 percent level if pre-continue variable is eliminated but insignificant when it is included.

than years beyond Ph.D. might have been a better variable to use. For the faculty in this sample the distinction is not important. It might also have been useful to control for whether an instructor previously taught principles or whether his major assignment was advanced undergraduate or graduate level courses. Again, the distinction is not important in this sample since all of the instructors had previous experience teaching principles and the within rank assignments were similar. Thus, the variable used in the study seems to be a reasonable one.

Consider the other coefficients in Table 2:

1. Note that the constant term in each of the regression is positive and significant. This suggests that other variables may be significant which have been excluded from the equation. Thusfar, the absence of an effective learning theory has prevented researchers from eliminating this problem in economic education studies.

2. The positive coefficient on grade point average suggests that students who do well in other courses also do well in economics. When this finding is combined with the lack of significance for the pre-interest, pre-continue, and student major variables it may suggest that a student's learning skill, rather than his prior interest in economics, is the crucial factor in determining how well he learns economic principles.

3. A student's pre-TUCE score presumably reflects his knowledge of economics when he enters the course. Surprisingly, a good pre-score does not appear related to a high final grade, perhaps again suggesting that prior exposure to the field is not as important as the ability to learn.

4. Performance on the pre-AS exam is significant in determining post AS score and final grade. Since the AS test presumably measures economic <u>reasoning</u> rather than prior knowledge, this may explain why AS is significant and TUCE is not. An increase of about 2.5 points on the pre-AS exam adds one point to the post AS score and 0.13 points to final grade.

5. A student's sex has no effect on the amount learned. However, women are less interested in economics both when they enter and when they leave the course. This is also reflected in fewer female continuations to other economics courses.

6. We know surprisingly little about what determines a student's interest in economics, either before or after the course.(8)(13)(14) This would seem to be a useful area for further research.

7. The hours taught variable is included in the regression to control for the effects of variation in workload on teacher effectiveness. It is difficult to interpret in a small sample, however, since hours taught are not evenly distributed across ranks. An increase in the number of hours taught appears to have an effect on post AS score and is significant at a 10 percent level in the final grade equation.[5]

8. Finally, although the $\bar{R}^2$'s are low, the F tests are all significant at a 1 percent level and the $\bar{R}^2$'s are in line with those of other researchers in this area.

The Effectiveness of Graduate Instructors

Other things equal, one might expect that since experienced teachers raise student scores on the TUCE and AS exams the addition of graduate instructors would reduce student learning. Many faculty involved in the principles sequence have noted, however, that graduate students enjoy certain advantages: an enthusiasm for the material, a better awareness of what the undergraduates don't understand, greater approachability, and perhaps a closer rapport with the students. Thus, it is difficult to

---

5. The regression coefficient is significant at a 5 percent level when all variables are included in the regression. A 5 percent level was used in determining which variables should be included in the table.

predict in advance the effect of assigning graduate students to teach the principles course.

During the summer of 1973, and in each of the following quarters, the economics department assigned graduate students to teach in the principles sequence. These students developed their material free from departmental directive, although they followed a common course outline and used the same textbook.[6] The sole criterion for selection of instructors involved their past TA evaluation ratings by students.[7]

If graduate instructors make a difference, this should be indicated by the inclusion of the Y_2 variable in the Table 2 regressions. However, a problem exists. Because of the small sample size, and because instructors teach fewer hours, Y_2 is highly correlated with hours taught. Moreover, since years beyond Ph.D. and the instructor variable are also highly correlated, the use of the three variables loads the dice against the graduate variable. It is, however, useful to know whether the Y_2 variable has an independent effect, after controlling for hours taught and experience. To resolve this dilemma two estimates are presented. The first excludes hours taught and experience from the equations estimated in Table 2 but includes the

---

6. The exception to this rule was the fall quarter where one faculty section and two graduate instructor sections covered the material in a coordinated manner. This was to provide further data which will be forthcoming in a future paper.

7. This practice differs from that of several other departments.(19)

Y_2 variable; the second includes the Y_2 variable with all of the significant variable equations in Table 2. Since our major interest is with the graduate instructor and teacher experience variables, only the regression coefficients and T-values for these are shown below. To facilitate comparison with Table 2, adjusted R^2's and F-values are also given.

TABLE 3

TWO ESTIMATES OF THE EFFECT OF GRADUATE INSTRUCTORS ON STUDENT PERFORMANCE

Graduate Instructor	Post TUCE	Post AS	Final Grade	Interest in Economics	Continue on in Economics
Estimate I	-0.362 (1.7)	1.011 (3.6)	-0.014 (0.2)	0.214 (1.6)	0.014 (0.3)
Estimate II	0.193 (0.7)	0.024 (0.1)	-0.311 (1.9)	0.214 (1.6)	0.014 (0.3)
Years Beyond Ph.D.					
Estimate II	0.044 (3.7)	0.085 (3.5)	*	*	*
Adjusted R^2					
Estimate I	0.16	0.23	0.21	0.09	0.21
Estimate II	0.18	0.25	0.22	0.09	0.21
F-Ratio					
Estimate I	23.09	48.57	32.76	16.06	25.53
Estimate II	21.78	32.68	27.53	16.07	25.53

Table Note: * denotes that the variable was not included in Table 2 because it lacked statistical significance.

The conclusion suggested by this table is that graduate instructors generally do about as well as faculty in the principles course. The specification of the equation makes a difference in terms of specific output measures, however. When a straight test of graduate instructors as compared to faculty is conducted, the results indicate that graduate instructors actually have a positive effect on student economic attitudes as compared to the faculty. In fact, the regression coefficients suggest that graduate instructors raise the AS score by an amount about equal to that of a faculty member with 12 years of experience. If the graduate instructor variable is included in the regression with teacher experience and hours taught, however, its regression coefficient is insignificant in the AS equation and negative and significant at the 10 percent level in the final grade equation. This seems to imply that graduate instructors do about as well as faculty on four performance measures but less well on the fifth. The two estimates can be reconciled. A micro view of the data suggests that the insignificant coefficient on Y_2 in the AS equation is due to the fact that the hours taught variable picks up the variation captured by Y_2 in estimate I. Eliminating this variable from the equation but including teacher experience, we again obtain a statistically significant regression coefficient for Y_2. As for the negative coefficient for the final grades equation, this appears to have been caused by a difference in

grading procedures rather than by student performance.[8]

Conclusions

Prior studies have raised a paradox which appears in our findings. Experienced teachers presumably improve student performance on learning exams yet graduate instructors appear to be as effective as faculty in the principles course. Can these two findings be explained? What may be involved here are two different types of teaching skills; in the case of the graduate students, an ability to grasp what students don't understand, a high degree of motivation, and greater approachability; in the case of experienced faculty, a broader background, more experience in teaching, greater self-confidence, etc. Given the approach followed in this study, one can only speculate as to which of the factors explains our results. Nevertheless, the findings themselves appear to support the view that graduate student instructors do as well as the faculty instructors in terms of both the learning and interest measures. This conclusion is in accord with that of Oates and Quandt for Princeton students.(19) Of course, it should be borne in mind that the measures of learning used here capture only part of the total learning environment. An

---

8. A major difference in grade distribution occurred in the fall quarter. A comparison of scores on the common final to final grades led to the conclusion that the graduate instructors in our sample were less generous with their grades than were the faculty.

effective instructor conveys many things not captured by any of the measures; command of the subject, caution in accepting unsupported arguments, a perspective on the economic system, etc. We have yet to develop measures which provide an effective comparison of faculty and graduate instructors along these lines.

APPENDIX: TABLE 1

Means and Standard Deviations for Independent Variables

Variable Name	Mean	Standard Deviation
Attitude Score (Pre)	11.28	3.54
Class Standing	2.43	0.85
Grade Point Average	2.54	1.04
Graduate Instructor	0.22	0.41
Pre-Continue	0.20	0.44
Hours Taught by Instructor	6.64	2.74
Major in Economics	0.10	0.37
Pre-Interest	2.64	0.93
Sex	0.43	0.50
TUCE Score (Pre)	4.37	4.44
Years of Experience of Instructor	7.60	9.21

REFERENCES

1. R. Attiyeh, G. Bach, K. Lumsden, "The Efficiency of Programmed Learning in Teaching Economics: The Results of a Nationwide Experiment," American Economic Review, May 1969.

2. R. Attiyeh, K. Lumsden, "Some Modern Myths In Teaching Economics: The U.K. Experience," American Economic Review, May 1972.

3. G. Bach and P. Saunders, "Lasting Effects of Economics Courses at Different Types of Institutions," American Economic Review, June 1966.

4. S. Buckles and M. McMahon, "Further Evidence on the Value of Lectures in Elementary Economics", The Journal of Economic Education, Spring 1971.

5. S. Bowles, "Towards an Educational Production Function" in Education, Income, and Human Capital, ed. W. Lee Hansen (New York: National Bureau of Economic Research, 1970) pp. 13-14.

6. E. Cohn, "Student's Characteristics and Performance in Economic Statistics," The Journal of Economic Education, Spring 1972.

7. A. Goldberger, Econometric Theory (New York: John Wiley and Sons, 1970).

8. A. Kelley, "Uses and Abuses of Course Evaluations as Measures of Educational Output," The Journal of Economic Education, Fall 1972.

9. A. Kelley, "Individualizing Instruction Through the Use of Technology in Higher Education," The Journal of Economic Education, Spring 1973.

10. A. Kelley, "An Experiment with Tips: A Computer-Aided Instructional System for Undergraduate Education," American Economic Review, May 1968.

11. C. Lamphear and C. McConnell, "A Note on the Use of Graduate Teaching Assistants in the Principles Course," The Journal of Economic Education, Spring 1970.

12. H. Levin, "New Models of School Effectiveness," Do Teachers Make a Difference? (Washington: G.P.O., 1971).

13. D. Lewis, D. Wentworth, C. Orvis, "Economics in the Junior College: Terminal or Transfer," The Journal of Economic Education, Spring 1973.

14. D. Lewis and T. Dahl, "The Test of Understanding in College Economics and its Construct Validity," The Journal of Economic Education, Spring 1971.

15. W. Mann and D. Fusfeld, "Attitude Sophistication and Effective Teaching in Economics," The Journal of Economic Education, Spring, 1970.

16. M. Meinkoth, "Textbooks and the Teaching of Economic Principles," The Journal of Economic Education, Spring 1971.

17. S. Michelson, "The Association of Teacher Resources with Children's Characteristics," Do Teachers Make a Difference? (Washington G.P.O., 1971).

18. C. McConnell, "An Experiment with Television in the Elementary Course," American Economic Review, May 1968.

19. W. Oates and R. Quandt, "The Effectiveness of Graduate Students as Teachers of the Principles of Economics," The Journal of Economic Education, Spring 1970.

20. D. Paden and M. Moyer, "The Relative Effectiveness of Three Methods of Teaching Principles of Economics," The Journal of Economic Education, Fall 1969.

21. D. Paden and M. Moyer, "Some Evidence on the Appropriate Length of the Principles of Economics Course," The Journal of Economic Education, Spring 1971.

22. M. Rothman and J. Scott, "Political Opinions and the TUCE," The Journal of Economic Education, Spring 1973.

23. H. Tuckman, "High School Inputs and Their Contribution to School Performance," The Journal of Human Resources, Fall, 1971.

24. H. Tuckman, The Demand for Higher Education: A Florida Case Study (Massachusetts: Lexington Books, 1972) Chapter 6.

25. D. Weidenaar and J. Dodson, Jr., "The Effectiveness of Economics Instruction in Two-Year Colleges," The Journal of Economic Education, Fall 1972.

26. A. Welsh and R. Fels, "Performance on the New Test of Understanding in College Economics," American Economic Review, May 1969.

27. The Psychological Corporation, Manual, Test of Understanding in College Economics (New York: the Psychological Corporation, 1968).